Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

NOTES AND COMMENTS.

THE SENSES IN THE LOWER ANIMALS.

THE five senses of man—sight, hearing, touch, smell, and taste—are possessed by some of the very lowest creatures in the animal kingdom. This fact has been clearly demonstrated by Hessen, Lubbock, Wolfe, and many others. In the earthworm, one of the lowest forms in the scale of animal life, we first find the primitive eye. Careful inspection shows us on the body of the worm certain circumscribed spots, darker than the surrounding skin. These spots have been overlooked by other workers in this field, and, have not been recognized as eyes. Darwin, while recognizing the fact that worms are sensible to light, declares that they are blind. These ocelli, or primitive eyes, are found on the dorsal surface of the common earthworm. A microscopic examination shows that the spots consist of, first, a transparent membrane; second, an accumulation of pigmentary matter, and, third, a special nerve spread out in the pigmentary matter and going thence to the central nerve structure. These ocelli are exceedingly minute, being only one twenty-five hundredth of an inch in diameter. I believe that the transparent membrane is a true cornea, the pigmentary matter a true retina, and the special nerve a true optic nerve. There is no lens, consequently the worm is only able to distinguish between light and darkness. It is an eye nevertheless, and the worm is not blind. The worm is a nocturnal animal, consequently experiments with artificial lights can easily be made. They will continue feeding as long as the light is dim, but immediately withdraw into their burrows when subjected to the bright rays emanating from a large Argand burner. Experiments prove that it is the bright rays which affect them. They do not regard the dark or heat rays unless these rays are focussed on them. The sense of touch is distributed over the surface of the worm, and the arrangement of the terminal filaments does not differ very materially from that in man. They are, strictly speaking, devoid of the sense of hearing. Sound waves, however, are transmitted to the sensorium through an analogous sense—that of touch. Worms possess the special senses of taste and smell. This is shown by their selecting certain kinds of favorite foods in preference to others not so much relished, and by their hasty withdrawal into their burrows when an objectionable scent is sprinkled near them. Thus, when cabbage and fennel are mixed and strewn near the orifices of their burrows, they will select the cabbage. They will devour the fennel greedily, if it alone is given them. The odor of musk is particularly objectionable to worms. It is amusing to see the rapidity with which they seek their burrows when a drop of this substance is placed in the vessel containing them. Rose, lily, verbena, and heliotrope odors do not affect them. Violet scent makes them slightly uneasy, causing them to move their bodies slowly from side to side. They probably derive pleasure from this scent. The nerves of taste and smell are blended together, and can be readily made out with the microscope in the lips, so to speak, of the oral pouch.

The eyes of ants are of two kinds, compound and simple. The compound eye, so-called from the fact that eight or many more facets go to make up a single eye, are two in number, one on each side of the head. The ocelli or simple eyes are on top of the head. The visual picture, made by the compound eye, is a mosaic of the object viewed; each individual facet making a portion of the whole. All the ants I ever examined microscopically had ocelli, except one specimen of *Formica fusca.* Some writers claim that these ocelli are not sight-organs; that they are not functional but merely ornamental. Careful microscopic examination, however, proves them to be true organs of sight. There is a transparent membrane, the cornea; the pigmentary accumulation, the retina; and the special nerve, the optic nerve in each of these ocelli. These ocelli have gone a step higher than those found in the earthworm, in evolutionary development. They have a central chamber filled with fluid, which is analogous to the anterior chamber and aqueous humor of our eyes. These ocelli, therefore, have the power of not only distinguishing the light, but can even form an image on the retina. The range of vision in an ant does not exceed twelve inches in the compound eyes. In the ocelli it is very much less; probably not over two inches. The sense of taste is located, in ants, in the tongue and jaws. I fed some ants with a few grains of white sugar. They ate it greedily. I then substituted some boracic acid. They stopped feeding at once after the first bite, and immediately proceeded to get rid of the objectionable tasting substance. Experiments and microscropic examination, show that their sense of smell is located in their antennæ. Their organs of hearing are located in their legs. If we examine the tibia of an ant we will find a curious enlargement of the trachea. In the femur the diameter of the canal is one three-thousandths of an inch, but when it enters the tibia, it swells to a diameter of one five-hundredths of an inch, then contracts to one seven-hundredths, and then again at the end of the tibia expands to one five-hundredths of an inch. At the upper sac, where it contracts, there is a conical striated organ which, in my opinion, bears a striking resemblance to the plates of Corti in our own ears. This organ has a special nerve, the auditory nerve. Ants can undoubtedly communicate with one another. Most authorities agree in saying that they communicate through their antennæ. They may communicate through sounds so low or so high that our ears, notwithstanding our four thousand plates of Corti, cannot perceive them, Microscopically, I can find no vocal organs or instruments of stridulation, such as we find in *Gryllus.* The lowest sound we can hear is probably about twelve vibrations to the second, while the highest is some thirty-five thousand vibrations Some men can distinguish sounds that cannot be noticed by other men. A music teacher gives me an instance of the fact in one of his pupils. When the piccolo stop is drawn, this pupil cannot hear the last note (A′′) in upper register of the organ. The plate of the Corti that vibrates in unison with this particular tone is absent in his ears. I have repeatedly noticed intelligent communication between ants. One day, while watching a herd of aphides and their attendant guards, I suddenly saw an army of *Lasius niger* approaching. They were marching in full battle array, with a skirmish line in advance. They came on with a rush, as if they intended a surprise. Some outposts, or pickets, of *Lasius flavus* discovered them when ten or twelve feet away from the town of *Lasivs flavus.* These pickets raced home and gave the alarm. Immediately the inhabitants poured out and arranged themselves in front of their beloved herd. Skirmishers were thrown out and soon met the advancing *Lasius niger.* In a few moments the battle was on, and it was a battle to the death. The *Lasius niger* outnumbered the *Lasius flavus* three to one. As near as I could reckon there were about 1,500 of the blacks and about 500 of the yellow ants. The yellow ants were larger and stronger, but the blacks were more agile. The yellow *Lasius* rushed at her enemy with open mandibles, and seizing her by the middle, crushed her through and through. The black *Lasius* endeavored to get behind her enemy and then seize her by one of her legs. If she succeeded in her attempt, no bull dog ever held on with greater tenacity. As soon as possible another black ant would come to her assistance, and mounting on the back of the yellow ant would begin at once to gnaw through the thoracic wall. In a few seconds the shell would be eaten through, the vitals would be reached, and the yellow ant would sink down in the struggle of death. Not until certain that she was dead would *Lasius niger*, who had her by the leg, loosen her hold. *Lasius niger*, in this foray, came in light marching order. They carried no commissariat department, no ambulance corps. *Lasius flavus*, on the contrary, had both. When wearied or wounded the yellow ants would drop to the rear and communicate their wants. The ambulance corps dressed their wounds with their tongues; the commissariat refreshed them by regurgitating food into their open jaws. All through the battle I noticed this wonderful power of intelligent communication. *Lasius flavus* sent repeatedly back to the town to bring out the stragglers. It was like a well-ordered battle between human beings. These ants acted as though governed by an intelligence analogous to that which directs the actions of man. In the end *Lasius niger* won the victory, but not until they had killed every *Lasius flavus*, and lost two-thirds of their own number. The survivors carried off the bone of contention, the herd of aphides, to their own nest, some fifty feet away.

JAMES WEIR, JR.

COLORADO'S BRIGHT OUTLOOK.

THE statement of Governor Waite in the January REVIEW that "the annual production of 27,000,000 ounces of silver cut off by the closing of the mines has deprived Colorado of about $24,000,000 per annum" is one which will not bear examination. The official figures just published in the annual reviews of the Denver papers show that in 1893 the silver product of the State was 23,017,089 ounces, against 26,542,135 ounces in 1892. The product for the past year sold for $17,797,890. The slight loss in quantity was unnecessary and was wholly caused by the needless shutting down of